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MAEDLER to have been struck by a Danish King, who must have been, according to Professor DUNÉR, King CHRISTIAN IV, the same who drove TYCHO BRAHE out of Uraniburg.

On the obverse, this medal displayed "a crowd of persons prostrate on the earth, and above them a terrible comet," and the reverse contained the following inscription :

"GOTT GIB, DASS UNS DIESER KOMET-STERN
BESSERUNG UNSERS LEBENS LERN! 1618."

or, set over into English, *God grant that this comet may teach us to amend our lives.*

Perhaps some of the correspondents of the A. S. P. can refer to a published engraving of this medal.

Professor R. WOLF, Director of the Observatory of Zurich, kindly refers me to his *Astronomische Mittheilungen*, No. 68, in which he has described a medal of the 1680 comet, which was presented by him to the Observatory of Zurich in 1887. E. S. H.

THE SOUTHERN CROSS—AND THE REPUBLIC OF BRAZIL.

The coins of the new Republic of Brazil bear (on the reverse) the effigy of the five chief stars of the constellation *Crux*, surrounded by the twenty-one stars which symbolize the separate provinces of the Republic.

The adoption of an astronomical symbol by the new confederacy is, perhaps, worthy of this passing note in an astronomical journal. E. S. H.

ON A BLACK TRANSIT OF THE IV SATELLITE OF *JUPITER*, OBSERVED ON AUGUST 13, 1890, WITH THE TWELVE-INCH EQUATORIAL OF THE LICK OBSERVATORY.

On the night of August 13th, while observing *Jupiter*, I saw what at first I took to be the shadow of one of the satellites on the disc. Referring to the Nautical Almanac, I found that it must be the IV Satellite in one of its black transits. Careful observations were made of it throughout the remainder of its transit. With all powers up to 500 on the twelve-inch it was perfectly black and round. No markings of any kind were seen on its disc. It was some distance preceding two of the singular small black spots that have appeared on the north edge of the equatorial belt, and was as near as possible at the same latitude. The surface of *Jupiter* rotating faster

than the apparent motion of the satellite, caused the small black spots to overtake it, and the preceding of the two was seen to catch up with and pass behind the satellite, and finally to emerge on the preceding side of it. The spot really passed very slightly north of the satellite's center and a very faint fringe of it was seen projecting slightly to the north at their conjunction, giving to that part of the satellite the effect of a penumbra, IV being much blacker than the spot.

When about three-quarters across the disc, IV appeared to have a slight brownish tinge—reddish-black—but later, this slight tinge of red disappeared and the satellite remained of a cold black color. The most singular phenomenon was presented when nearing emergence. It became smaller as it approached the limb, and seemed extended slightly north and south. It did not appear to lose in blackness so much as it did in size. Finally, while it, as a very small black speck, seemed not yet in contact with the limb, a small portion of its disc was seen protruding beyond the edge of the planet, and, when nearly half off, this portion did not appear round, but was wedge-shaped. As the satellite emerged, that part remaining on continued black, while the portion off the disc was as bright as the adjacent part of the planet. It seemed to leave the dark part behind, as it were, which, being crowded into a smaller and smaller space on the disc of the satellite, as it emerged, finally disappeared from smallness rather than from any loss of its blackness. When at last the satellite was free from the disc of *Jupiter*, it appeared extremely small and of a uniform pale, ashy tint—no spot or marking being visible upon it. As compared with Satellite I, which was near it and preceding, it was not over one-quarter as large as that satellite in diameter, and many times less bright.

During the latter part of the transit, except at the time of emergence, Mr. SCHAEFERLE watched the phenomenon with me. After emergence, we agreed that if the satellite were a disc as big as *Jupiter*, its albedo would be considerably less than that of *Jupiter*, though I was at first inclined (erroneously) to place it a little brighter than the planet. A small spot of light on a dark background is apt to appear brighter than a large surface, which is really brighter than the small spot, a fact that in estimations of this class is too important to neglect. Matched with the belt on which it appeared so inky black, it seemed to be of about the same brightness. The satellite appeared to lack luster, when compared with the surface of *Jupiter*.

During the transit I measured the distance of the centre of the satellite from the north and south limbs of *Jupiter*, the wires being

parallel with the north edge of the equatorial belt. The following are the measures in local sidereal time :

$$19^h 49^m 11^s \text{ center of satellite from north limb} = 18''.2 \text{ (3)}$$

$$19 \ 54 \ 49 \text{ center of satellite from south limb} = 28''.4 \text{ (3)}$$

An attempt was made to measure its diameter during transit, but the seeing became too poor for the necessary high power to be used. The wires were, however, placed alongside the satellite and then separated until, by careful estimation, their centers were separated by the apparent diameter of the satellite, the resulting value being, at sidereal $20^h 10^m.6$, $= 2''.0$, which is to receive but very little weight.

By a careful estimation with the micrometer wire bisecting the satellite, and perpendicular to the belts, IV transited the apparent central meridian of *Jupiter's* disc at $9^h 42^m.2$ Mt. Hamilton mean time. Comparing this with the time derived from the entrance on to and departure from the disc, as given in the American Ephemeris, the satellite was between 14^m and 15^m ahead of its predicted time, this being verified by the observations at emergence.

When near the middle of its transit, Mr. SCHAEBERLE and myself, after a careful examination, agreed that the satellite was absolutely black and round.

The observations of this black transit, made under more favorable circumstances than any I have seen, fully convince me of the fallacy of the theory that they are due to "the sudden formation of vast areas of non-reflective surface on the satellite." The cause must be sought, not in dark spots or surfaces on the satellite, but in some peculiar influence that exists only during the time of transit—perhaps some peculiar phenomenon of light itself, as was suggested to me some years ago as a possible explanation. After observing this transit, in connection with what I have seen, both in the case of IV and III, and witnessing the phenomena there presented, I would not subscribe for one moment to the theory of spots or local changes on the face of the satellite—the explanation must be sought elsewhere. However, I must not be understood to say that there are not dark spots on the satellites—for, in June of last year, on several fine nights, with 700 on the twelve-inch, I distinctly saw irregular dark spots on III.

The importance of these dark transits requires that any notes pertaining to them should be published. I therefore append, nearly in full, my notes of this transit of August 13. The times are local sidereal time :

19^h 25^m. The satellite is round and black as ink. With powers 500, 240, 175, 150, it is perfectly black, round and sharply defined. It is larger and blacker than the small dark spots following it.

19^h 56^m. Still inky black.

20^h 24^m. IV coincides with the first black spot, and is still very black.

20^h 32^m. Still black.

20^h 34^m. It does not now appear so black; it is hazy and brownish, poor seeing. Shadow of IV on, at the following limb, and is as black as ink, but no blacker than IV was at transit.

20^h 40^m. IV is reddish brown, while its shadow is inky black.

20^h 50^m. Not quite so black as its shadow, yet it is black. It is three-quarters as large as its shadow.

21^h 6^m. Still black, but not quite so black as its shadow nor so large.

21^h 10^m. Still very dark, or black. I do not now notice any brown color; it is simply a less decided black than its shadow. This with power 175.

21^h 13^m. With 150 it is scarcely less black than its shadow, but not over two-thirds as large.

21^h 17^m. Nearing limb; still black.

21^h 24^m. Black yet, and small.

21^h 29^m. Still very dark and one-half as large as its shadow; much darker than the spot following it.

21^h 30^m. It appears bright on its preceding side; still dark.

21^h 31^m. Considerably fainter and smaller; not yet in contact.

21^h 32^m. Still dark, paler and quite small.

21^h 33^m. Very small and faintish; not yet in contact; about one-fifth as big as its shadow.

21^h 34^m. Now fainter and a little smaller than the black spot following it; not yet in contact.

21^h 35^m. Very small, faint speck.

21^h 35½^m. Part is protruding. This is as bright as the limb. The remaining portion within the limb is dark. It is one-half off.

21^h 36½^m. Outside part brighter than the limb; inside portion darker.

21^h 38^m. Protruding part is wedge-shaped. It is as bright as the limb; that portion on disc not visible.

21^h 40^m. Not yet off.

21^h 42^m. Quite small; just in contact, and brighter than adjacent belt.

22^h 35^m. IV is about one-half the diameter of Satellite I in size, and about one-half as bright as that satellite. It is still ashy in color, and is apparently a little brighter than the reddish equatorial belt, on which it appeared so black.

While these observations were going on, a telephone message was received at the Observatory, from Mr. C. B. Hill, at the Chabot Observatory, kindly calling attention to the phenomenon. E. E. B.

MT. HAMILTON, August 15, 1890.

SOME PHOTOGRAPHIC EXPERIMENTS WITH THE GREAT TELESCOPE.

A plate was exposed, on August 4, on the multiple star *Epsilon Lyrae* which is composed of the two pairs 4 *Lyrae* (magnitudes 4.6 and 6.3, distance 3".1) and 5 *Lyrae* (mags. 4.9 and 5.2, distance 2".4) with the full aperture, and with exposures of 0^s.13, 1^s, 2^s, 4^s, 8^s and 16^s. *Alpha Lyrae* (first magnitude) was similarly exposed on the same plate (Seed 26). Four other stars show also; namely,

w,	D M.	38°,	3229,	magnitude	7.3
x,	D M.	39°,	3505,	"	6.5
y,	D M.	38°,	3237,	"	7.8
z,	D M.	39°,	3514,	"	8.5

Some of the results from this plate may have more than a special interest, as they will show what is to be expected (and what is *not* to be expected)* from a photographic lens with the unusual relation of aperture (33 inches) to focus (570.2 inches) of 1 to 17. In such a lens 1" of arc is about 0.0028 inches, and two stars at a distance of 3", or even less, should show on a plate which has had the proper exposure. In fact the 1^s exposure gives very good and perfectly well-measurable images of all the stars down to magnitude 7. The probable error of a measure of the distance of the close doubles 4 and 5 *Lyrae* is not above 0".02 or 0".03.

The diameters of the star discs are—approximately only—for

a star of	4.6 mag.,	exposed	1 ^s ,	diameter	= 1".3
"	4.9	"	"	1	" = 1.9
"	5.2	"	"	1	" = 1.2
"	6.3	"	"	1	" = 1.1
"	6.5	"	"	1	" = 0.7
"	7.3	"	"	1	" = 1.3
"	7.8	"	"	4	" = 1.5
"	8.5	"	"	8	" = 1.2
"	8.5	"	"	16	" = 1.5
"	8.5	"	"	4	is just measurable for position.

* "Jedes Fernrohr hat seinen Himmel."